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Title: The behavioral effects of walking on a collar and harness in domestic dogs (*Canis familiaris*)

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Abstract

Dogs are a popular pet in the United Kingdom and walking a dog is widely recognized as an important part of dog ownership. A number of different restraints can be used when walking dogs on leashes such as collars and harnesses. Previous research has examined the behavioral effects of walking dogs on head and neck collars. Harnesses are often anecdotally proposed to be more beneficial to dog welfare than other alternative restraints, however to date the effects of walking dogs on harnesses have not been investigated. The aim of this study was to determine the behavioral responses of dogs walked on neck collars or harnesses. The broader purpose of this study was to examine if the type of restraint worn causes stress in dogs. In order to explore this, a within-subject counterbalanced design was used. Thirty privately owned dogs were recruited within two groups (each group: n=15); those previously walked on a harness and those previously walked on a neck collar. Dogs were walked for 20 minutes each while behavioral indicators of stress were recorded. Post this trial, owners were given the alternative walking restraint and returned a week later to perform a second 20 minute walk. Behavioral indicators were again recorded. No significant differences were found between behaviors shown by dogs when walked on either collar or harness. However dogs with a history of being walked on a collar showed increased low ear position. This may suggest that these dogs are more stressed however due to the lack of support from the other stress indicators, motivations, such as indicating appeasement toward their owners, should also be considered. These findings suggest that, at least for the specific harness and collar trialed, neither neck collars nor harnesses are eliciting stress in dogs. However, future research determining the long-term effects of neck collar and harness use would be beneficial.

Introduction

Domestic dogs are a popular pet in the United Kingdom with almost a quarter of households owning a dog (PFMA, 2014). Walking a dog is generally considered an essential

part of owning a dog (e.g. DEFRA 2013; Kennel Club, 2014; RSPCA, 2014). Various restraints are used when walking dogs on leashes, most commonly, collars (head or neck) and harnesses.

The type of restraint used is of potential importance as it may have a detrimental effect upon canine welfare. While a leash attached to a neck collar is the most common form of restraint in most countries, concern has been raised over the potential for them to cause damage to the neck and trachea (Landsberg et al., 2012). Neck collars can also have a negative effect on the welfare of individuals with eye conditions such as glaucoma or weak corneas (Pauli et al., 2006). Head collars or harnesses may also be more suitable for specific breeds of dog, such as those possessing slim delicate necks which may potentially be damaged by collars. Whether specific forms of restraint affect canine welfare is of obvious concern. In addition, recent legislation requiring dogs to be restrained by a leash on public land (UK Government, 2015) highlights the importance of determining if there are welfare concerns inherent in the use of different restraint types.

Previous research has looked into the behavioral and physiological responses of dogs wearing head and neck collars (Ogburn et al., 1998; Haug et al., 2002). No marked physiological differences were found between dogs wearing either of these collar types although dogs were more unruly and disobedient when wearing the neck collar, but While fought the leash and pawed at their noses more when wearing a head collar (Ogburn et al., 1998). No behavioral differences were found between dogs when comparing four different types of head collars (Haug et al., 2002).

Harnesses are often proposed to be a more welfare-friendly method of restraint however, to our knowledge, no previous studies have examined the behavioral responses of dogs to harnesses. The objective of this study was to determine whether being walked on neck collars or harnesses causes stress in dogs. Neck collars were used as a standard of comparison due to their widespread use as a form of restraint. Behavioral responses between (a) dogs currently walked on a neck collar or a harness (e.g. during the study trials)

and (b) dogs with a history of being walked on neck collar or harness (e.g. on previous walks prior to the study trials) were assessed.

Materials and methods

Subjects

Dog owners were recruited using opportunistic sampling from veterinary surgeries around Malvern, UK, and via promotion on the social media site Facebook™. The subjects consisted of 30 privately owned dogs, 19 males (14 neutered, 5 entire) and 11 females (9 neutered, 2 entire) ranging in age from 18 months to 11 years. Purebred dogs constituted 50% of the sample, with the remaining dogs being cross or mixed breeds. Participants were adult dogs (>18 months), healthy and had no previous history of behavioral problems. The dogs consisted of two groups (each group: n=15); those previously walked on a harness (Perfect Fit™ Harness, Dog Games, UK) and those previously walked on a neck collar. Within the group of dogs previously walked on a harness there were 10 males (6 neutered, 4 entire/intact) and 5 females (4 neutered, 1 entire/intact). Within the group previously walked on a neck collar there were 9 males (8 neutered, 1 entire/intact) and 6 females (5 neutered, 1 entire/intact).

Study Site

The walking trials were carried out on a 23294m^2 (perimeter 716m) fallow but recently mown field near Welland in Worcestershire, UK. Two equivalent 60m x 30m sections of the field were marked out using poles with colored flags. A 5m distance of each section from the field edges was maintained to increase uniformity of the walk. A novel area was used for each restraint condition to try to avoid the dog's memory or experience on the first walking trial affecting its performance in the second walking trial.

Walking Trials

A within-subject counterbalanced design was used in this study. This allows each individual to act as its own control. Participating owners were asked to bring their dogs to the study site between the hours of 7.00 to 11.00am. The owner was asked to walk their dog around one of the two marked out areas for a period of 20 minutes using the standard neck collar or harness protocol to which the dog was accustomed. The walking restraint used was the collar or harness with which the dog was familiar. All dogs walked on a harness restraint utilized Perfect Fit™ harnesses (Dog Games, UK) While for dogs walked on neck collars the restraints were from various manufacturers.

A short 1m leash was used to standardize the approach. Short leash walking is representative of the majority of on-leash walking in a UK population (Westgarth et al., 2015). The central 10 minutes of these walks were filmed using a digital video camcorder (Sony HDR-PJ620) from a vantage position approximately 5m from the northern long edge of each marked area. In an attempt to standardize the distance walked the owner performed a practice circuit of the marked out area without their dog, aiming to take a pace every second. The owner was then asked to try to maintain this walking speed during the dog walks. The owner was also asked not to verbally or nonverbally communicate with the dog during the walk. However in the event that the dog stopped, a short verbal command or tug on the leash was used to recommence walking. In addition, in order to attempt to mediate the effects of environmental novelty, the dogs were habituated to the field for 10 minutes prior to the walking trials.

After the initial walking trial, the owner was given the alternate walking restraint. This was either a fleece-lined neck collar (Dog Games, UK) or a Perfect Fit™ Harness (Dog Games, UK) (Figure 1). An explanation of how to use this device, along with its correct fitting was provided following manufacturer recommendations and the owner was asked to walk their dog on this novel restraint following their normal walking patterns for the period of one week to allow habituation to the device. The owner was then asked to return a week later to

the study site to perform a 20 minute walk around the second marked out area utilizing the novel restraint and following the same procedure as detailed previously. Each owner and dog completed the second walk at the same time as for their initial walk to facilitate individuals acting as their own control.

Behavioral analysis

The 10 minute videos were analyzed by an independent observer. Analysis was performed in a random order with respect to collection date and the dogs' history of walking restraint in order to prevent interpretation bias due to the viewer's expectations. Focal sampling of behaviors was used to record the frequency with which different behaviors were performed (Table 1). These behaviors were either potentially associated with canine stress (licking lips, yawning, low body position, low tail position, ears held low or pulled back, vocalizations, paw lifting, looking at owner, panting and trembling/body shaking) (Beerda et al., 1997; Beerda et al., 2000; Prato-Previde et al., 2003; Rooney and Bradshaw, 2014) or related to potential restriction of movement in dogs on the different restraint devices (sniffing ground, tracking and stopping). Behavioral measures were assessed individually for each dog to negate the issues of breed differences.

Statistical Analysis

The total number of times each dog was observed performing each behavior was summed providing an overall frequency count per dog per behavior. Robust two-way mixed ANOVAs were performed to look at the effects of restraint history and restraint condition on behavioral frequencies. The between group variable was restraint history (collar or harness) and the repeated measures variable was restraint condition (collar or harness). Robust two-way mixed ANOVAS with bootstrapping were performed as the assumptions underlying parametric analysis were not sufficiently met in terms of homogeneity of variance (Levene's

tests: >0.05). All statistical analysis was performed using R Statistical Software (version: 3.2.0; package: WRS2).

Results

No occurrences of vocalizations or low body position were observed in any of the dogs under any of the conditions so were excluded from the analysis. No significant differences were found between restraint history and restraint conditions for any of the behavioral indicators bar ears back behavior. The mean frequency of the behavioral stress indicators tended to be low in both collar and harness trial conditions (Yawning: Harness= 0.83; Collar= 0.69; Low tail position: Harness= 0.83; Collar= 1.10; Trembling: Harness= 1.10; Collar= 0.59; Paw lifting: Harness= 0.45; Collar= 0.21) though moderate mean frequencies were seen for some behavioral stress indicators in both trial conditions (Panting: Harness= 3.90; Collar= 4.69; Looking at owner: Harness= 4.52; Collar= 4.03) and one behavioral stress indicator was relatively high in both conditions (Licking lips: Harness= 11.62; Collar= 9.41). Classification of the display of behavioral stress indicators as low or high was based on the frequency of behaviors reported in Beerda et al., (1997) under stressful and control conditions. Indicators relating to potential restriction of movement in dogs on the different restraint devices were similar in both collar and harness trial conditions (Sniffing ground: Harness= 18.21; Collar= 21.10; Tracking: Harness= 7.34; Collar= 5.69; Stopping: Harness= 6.34; Collar= 5.93) (Figure 2).

Ears held low or pulled back

There was a significant main effect of restraint history on ears back behavior, Q = 10.9442, p = <0.01, but there were no main significant effects of restraint type, Q = 0.9034, p = 0.3593, or a significant restraint history x restraint type interaction, Q = 0.2886, p = 0.6002. After bootstrapping, ears back behavior was significantly higher in dogs with a history of wearing a collar, Ψ = 2.4657, p = <0.05 (Figure 3). There was no significant effect of

restraint type, Ψ = -0.8148, p = 0.087, nor was there a significant interaction effect, Ψ = -0.8297, p = 0.5060.

Discussion

Neck collars are widely used as a form of canine restraint, but concerns have been raised about their use (e.g. Pauli et al., 2006; Landsberg et al., 2012). Harnesses are an alternative form of restraint which have been anecdotally proposed to be better for canine welfare. In this study, no significant differences in behavior were found between dogs walked on either a neck collar or a harness. The lack of stress responses shown under either condition suggest that dog welfare is not compromised by either restraint type. This finding may be of relevance to owners concerned about using either form of restraint and to trainers advocating the use of a particular restraint type.

While no differences were found between dogs walked on collar or harness, restraint history was found to have an effect for one of the behavioral indicators. Increased low ear position was found in dogs with a history of being walked on a neck collar. Low ear position has been proposed to indicate stress (e.g. Beerda et al., 1997; Schilder and van der Borg, 2004; Rooney and Bradshaw, 2014) thus suggesting that dogs with a history of wearing a neck collar are more stressed when walked on either restraint device. However, it is important to note that this indicator was not supported by other stress measures. There was also no significant difference in ear position found between dogs walked on either a neck collar or harness such that no effect of restraint type was observed. This explanation should thus be viewed with caution and it is possible that different reasons may exist for the increased low ear position such as indicating “appeasement” toward their owners (Ogburn et al., 1998; De Palma et al., 2005).

There are a number of limitations to this study such as the sample size and the lack of control for morphology, breed and sex effects, however this study marks the first, to our knowledge, to compare the behavioral responses of dogs to collars and harnesses. Our

findings are suggestive that, at least for the specific harness and neck collar trialed, neither are causing stress to dogs. To further this work, future study with a larger sample size, consideration of a range of different brands of harness and collar, use of physiological stress indicators, such as cortisol, and assessment of such measures as canine gait and the magnitude of pulling while on the different restraints should be considered.

Conclusions

Based on the findings of this study, it seems that, at least for the specific harness and collar trialed, neither collar nor harness result in a difference in the dogs' behavioral stress responses. Considering the low levels of frequencies of stress indicators displayed by the dogs this is suggestive that neither restraint type are causing dogs stress. However further research into the long-term behavioral, as well as the physiological, effects of neck collar and harness use would be beneficial.

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Ethical Consideration

The study was based on voluntary participation, and the aims and procedures of the study were fully disclosed to participants. Participants provided informed consent. Approval for the study was not needed under the ASPA 1986 or the EU Directive 2010/63/EU. The study abided by the guidelines of the institutional Research Ethics Committee.

Conflict of Interest

John Grainger is Office Manager for Dog Games Ltd. Dog Games Ltd funded this research, as well as funding John's postgraduate studies during which this research was undertaken. Dog Games Ltd designed the Perfect Fit™ Harness which was utilized in this study. The other authors have no conflict of interests to declare.

Authorship

The idea for the article was conceived by John Grainger. The experiments were designed by John Grainger and V. Tamara Montrose. The experiments were performed by John Grainger. The data were analyzed by Alison Wills. The article was written by all the authors.

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Table 1: Ethogram providing description of behaviors sampled in the canine walking trials (based on Beerda et al., 1998; Rooney et al., 2009; Part et al., 2014; Rooney and Bradshaw, 2014).

Behavioral Sign	Description
Licking lips	Dog's tongue protrudes and licks own lips or snout.
Yawning	Dog opens mouth wide and closes eyes without vocalizing.
Low body position; crouching, cowering	Dog changes from normal walking position to one lower to the ground, crouches or cowers behind owners' legs.
Ears held low or pulled back	Dog's ears pulled back from normal position.
Low tail position	Dog's tail held in a position lower than the plane of the back.
Vocalizations, e.g. whining, whimpering	Dog produces prolonged high-pitched plaintive vocalizations. Mouth may be open or closed.
Trembling/Body Shaking	Dog exhibits clear shivering of the body.
Panting	Dog breathes deeply and quickly with mouth open and tongue hanging out.
Paw Lifting	While sitting or standing, the dog picks up and holds one of its front paws off the ground.
Looking at owner	Dog turns head and looks towards owner.
Sniffing ground	Dog orientates nose to within 5cm of an object, wall or ground and twitches nose.
Tracking	Dog moves along the ground with head lowered, using nose to follow a scent. Duration >2 seconds.
Stopping	Dog stops walking without other cause (e.g.

	urination/defecation.

Figure Captions:

Figure 1: An example of the neck collar (left) and harness (right) used during the study.

Figure 2: Frequency of behavioral stress indicators displayed by dogs within the collar and harness trial conditions. Means plus standard deviation are displayed.

Figure 3: Increased frequency of low ear position is displayed by dogs with a history of wearing a collar. No effect of restraint type on low ear position is seen. Means plus bootstrapped 95% confidence intervals are displayed.

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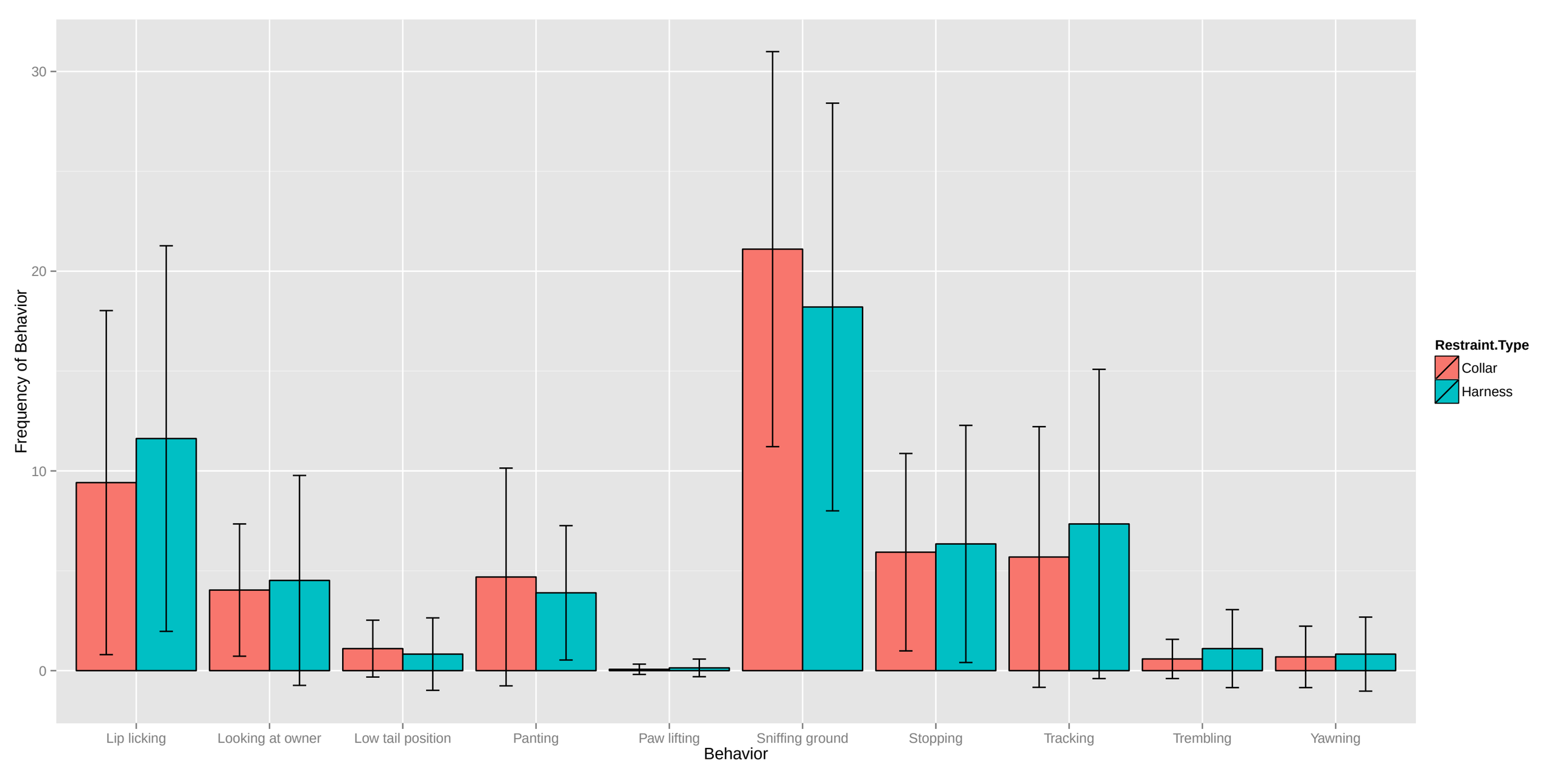
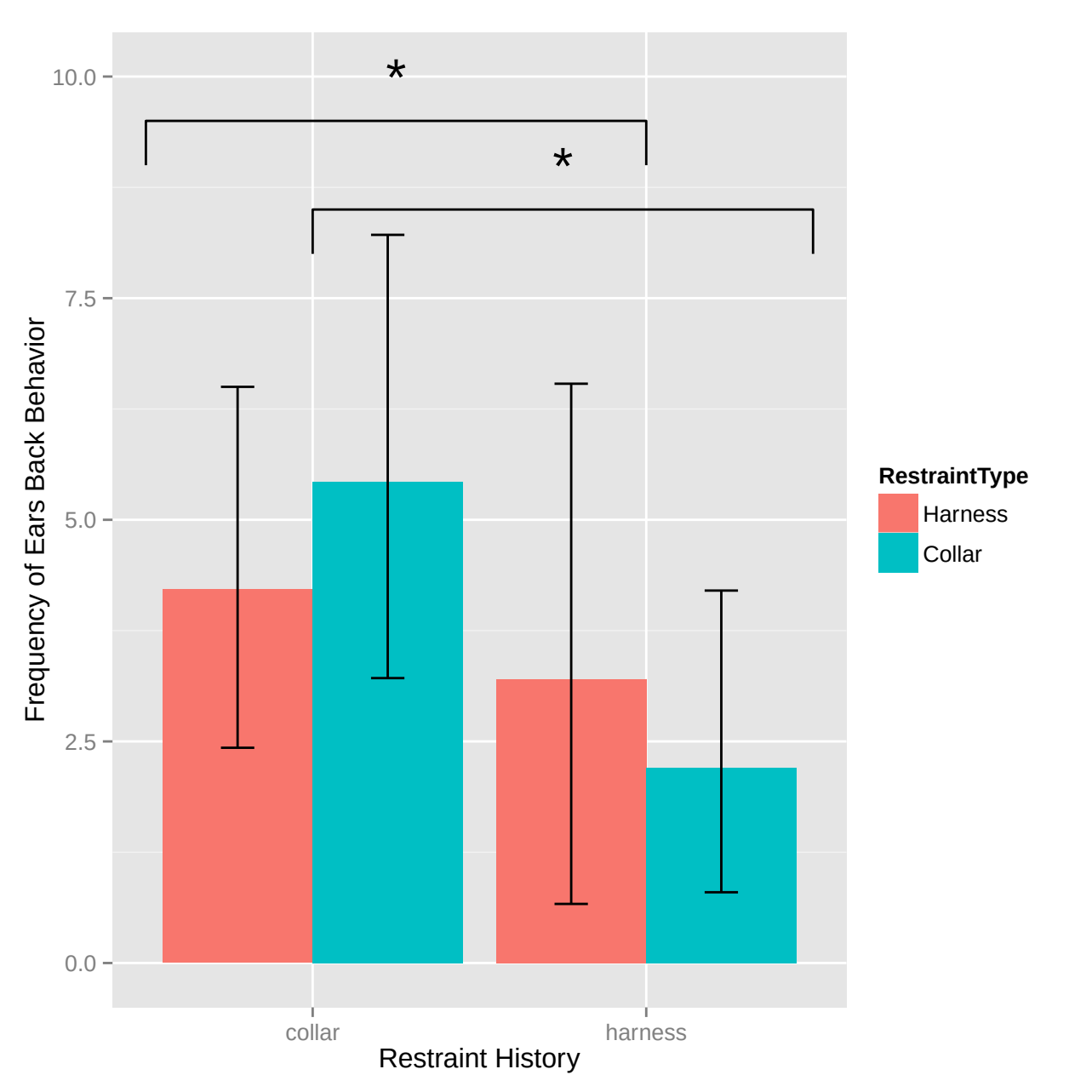

30
20
10
0
Frequency of Behavior
Lip licking
Looking at owner
Low tail position
Panting
Paw lifting
Sniffing ground
Stopping
Tracking
Trembling
Yawning
Behavior
Restraint.Type
Collar
Harness


10.0
7.5
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Frequency of Ears Back Behavior
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collar
harness
Restraint History
RestraintType
Harness
Collar